

What Is Claimed Is:

1. An allocation method for a storage area of a storage device to a virtual volume in a storage system having a plurality of virtualization apparatuses that allocate the storage area which the storage device has, form a plurality of virtual volumes, and process input-output from a host processor to one of the virtual volumes, comprising the steps of:

issuing, to the plurality of virtualization apparatuses, a request for completing all the input-output being processed received from the host processor and temporarily holding the input-output processing that is received subsequently;

receiving, from the plurality of virtualization apparatuses, a completion report of the input-output processing being processed in response to the request;

sending an instruction of an allocation change of the storage area of the storage device to all the virtualization apparatuses when receiving the completion report from all the virtualization apparatuses to which the request was issued;

receiving the completion report of the allocation change from all the virtualization apparatuses; and

sending an instruction for releasing a state of the input-output held temporarily to all the virtualization apparatuses.

2. An allocation method for a storage area according

to claim 1, wherein a table storing configuration information that associates the virtual volume with the storage area that becomes a real area of the storage device is prepared in a memory in advance, and

5           when an instruction of the allocation change of the storage area is sent, difference information of the configuration information is sent, and the virtualization apparatus changes the configuration information on a relevant entry of the table.

10           3. An allocation method for a storage area according to claim 1, wherein the virtualization apparatus that did not receive the completion report of the input-output processing is removed from a control range and the allocation of the storage area is not changed.

15           4. An allocation method for a storage area according to claim 1, wherein whether the input-output is held temporarily or not is controlled aiming at an address range including a location where the allocation is changed on the virtual volume.

20           5. An allocation method for a storage area according to claim 1, further comprising the step of copying data to the storage area of the storage device to which the virtual volume is newly allocated from the storage area of the storage device to which the virtual volume has already been allocated before the instruction of the allocation change of the storage area is sent.

25           6. A storage system, comprising:

a storage device that can specify a plurality of storage areas;

a plurality of virtualization apparatuses that allocate a storage area which the storage device has, form a plurality of virtual volumes, and process input-output from a host processor to one of the virtual volumes; and

a configuration change controller for changing an allocation configuration of the storage area of the storage device to the virtual volume, wherein

10 the configuration change controller includes:

means for requesting temporary hold of the input-output to all the virtualization apparatuses,

the virtualization apparatus that received the request includes:

15 means for completing the input-output being processed, shift to a state of temporarily holding an input-output request from a host processor subsequently, and returning a completion report of the input-output processing to the configuration change controller, and

20 the configuration change controller includes:

means for instructing an allocation change of the storage area of the storage device to the virtual volume to the virtualization apparatus when receiving the completion report from all the virtualization apparatuses to which a request was  
25 issued.

7. A storage system according to claim 6, wherein the configuration change controller includes:

a configuration change control program that includes the request means, means for receiving the completion report from  
5 the virtualization apparatus, and the change instruction means;

a processor that executes the configuration change control program;

a memory that stores a configuration information table registering configuration information that associates the  
10 virtual volume with the storage area that becomes a real area of the storage device and a difference information table recording a difference before and after the change of the configuration information,

the virtualization apparatus, includes:

15 a configuration management program that performs processing of a configuration change;

a processor that executes the configuration management program; and

a memory that stores a configuration information table  
20 registering the configuration information that associates the virtual volume with the storage area that becomes the real area of the storage device and a difference information table recording the difference before and after the change of the configuration information, and

25 the configuration change controller sends the differenc

information of the configuration information to the virtualization apparatus with reference to the difference information table when sending the instruction of the allocation change of the storage area, and the virtualization apparatus  
5 executes the configuration management program by the processor and changes the configuration information of a relevant entry of its own the configuration information table in accordance with the received difference information.

8. A storage system according to claim 6, further  
10 including a management console comprised of an input unit that inputs a request of the change of the configuration information to the configuration change controller and a display unit that displays a status of the configuration change.

9. A virtualization apparatus that allocates a storage  
15 area which a storage device has, form a plurality of virtual volumes, and process input-output from a host processor to one of the virtual volumes, comprising:

a configuration change control program for changing a configuration of associating the virtual volume with the storage  
20 area that becomes a real area of the storage device; and

a first processor that executes the configuration change control program, wherein

the program includes:

means for requesting an input-output temporary hold to  
25 another virtualization apparatus before changing the

configuration of associating the virtual volume with the storage area that becomes the real area of the storage device;

means for allowing the other virtualization apparatus that received the request to complete the input-output being  
5 processed, subsequently shift to a state of temporarily holding an input-output request from a host processor, and return a completion report;

means for instructing, to the other virtualization apparatus, an allocation change of the storage area of the  
10 storage device to the virtual volume when receiving the completion report from the other virtualization apparatus;

means for receiving the completion report of the allocation change from the other virtualization apparatus; and

means for sending an instruction for releasing the state  
15 of the input-output held temporarily to the other virtualization apparatus.

10. A virtualization apparatus according to claim 9, further comprising:

a memory storing a configuration information table  
20 registering configuration information that associates the virtual volume with the storage area that becomes the real area of the storage device and a difference information table that records a difference before and after a change of the configuration information;

25 a configuration management program for receiving a

request from the configuration change control program to temporarily hold changing input-output and change configuration information; and

a second processor that executes the configuration management program, wherein

contents of the configuration information table are updated by executing the configuration management program by the second processor.

11. A virtualization apparatus according to claim 10, wherein the first processor and the second processor are comprised of the same processor.

12. A virtualization apparatus according to claim 9, wherein the configuration change control program further comprises means for performing arbitration processing to limit the first processor that executes the respective means of the configuration change control program.

13. A virtualization apparatus according to claim 10, wherein the configuration information table comprised of a plurality of faces is prepared and a table of each face is switched.

14. A virtualization apparatus according to claims 9, further comprising:

when changing a configuration from one storage area to which the virtual volume corresponds to another storage area,

a copy processing program for copying and processing data

to the other storage area; and

a copy progress table that manages a progress status of the copy processing of the data using the copy processing program.

5           15. A storage device comprising a plurality of storage areas for providing a real storage area and a virtualization apparatus that allocates the storage areas, forms a plurality of virtual volumes, and processes input-output from a host processor to one of the virtual volumes, wherein the  
10 virtualization apparatus includes:

means for requesting an input-output temporary hold to another virtualization apparatus before changing a configuration of associating the virtual volume with the storage area that becomes a real area of the storage device;

15           means for allowing the other virtualization apparatus that received the request to complete the input-output being processed, subsequently shift to a state of temporarily holding an input-output request from a host processor, and return a completion report;

20           means for instructing an allocation change of the storage area in regard to the virtual volume to the other virtualization apparatus when receiving the completion report from the other virtualization apparatus;

            means for receiving the completion report of the  
25 allocation change from the other virtualization apparatus; and



means for sending an instruction for releasing the state of the input-output held temporarily to the other virtualization apparatus.

16. A storage device according to claim 15, wherein there  
5 are provided a configuration change control program for realizing each of the above means and a processor that executes the program.

17. A storage device according to claim 15, wherein there  
is provided a copy control unit for copying data from a storage  
10 area to another storage area when the configuration is changed from the storage area that becomes an object of the allocation to the virtual volume to the other storage area.

18. A change method for allocation of a storage area  
of a storage device to a virtual volume in a plurality of virtual  
15 apparatuses that process input-output from a host processor to the virtual volume, comprising the steps of:

issuing, to the plurality of virtualization apparatuses,  
a request for temporarily holding the input-output processing  
that is received from the host processor after a certain point  
20 of time;

making the respective virtualization apparatuses change  
the allocation of the storage area of the storage device on  
the condition that a report indicating completion of the  
processing of the input-output being processed in response to  
25 the request was received from the respective virtualization

apparatuses; and

releasing a state of the input-output held temporarily after the completion report of the allocation change is received from the respective virtualization apparatuses.

5        19. A change method according to claim 18, wherein the step of inputting an instruction of a configuration change from a management console is included and the request for temporarily holding the input-output is issued in accordance with the input instruction.

10        20. A program for a configuration change that changes allocation of a storage area of a storage device to a virtual volume in a storage system including a plurality of virtual apparatuses that allocate a storage area which the storage device has, form a plurality of virtual volumes, and process  
15 input-output from a host processor to one of the virtual volumes, comprising:

means for issuing, to the plurality of virtualization apparatuses, a request for completing the input-output being processed received from the host processor and temporarily  
20 holding the input-output processing that is received subsequently;

means for receiving, from the plurality of virtualization apparatuses, a report indicating completion of the processing of the input-output being processed in response to the request;

25        means for instructing the allocation change of the storage

area of the storage device to all the virtualization apparatuses when receiving the completion report from all the virtualization apparatuses to which the request was issued;

means for receiving the completion report of the  
5 allocation change from all the virtualization apparatuses; and

means for sending an instruction for releasing a state of the input-output held temporarily to all the virtualization apparatuses.